



“WASPS,

*And how they Live.”*

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*British Social Wasps,*

— AND THE —

*Habitations they Construct,*

— BY —

*Edward Connold.*

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# Wasps,

AND HOW THEY LIVE,

OR

BRITISH SOCIAL WASPS

AND THE

HABITATIONS THEY CONSTRUCT.

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A PAPER READ BEFORE THE MEMBERS OF  
THE HASTINGS & ST. LEONARDS NATURAL HISTORY SOCIETY,  
IN THE MUSEUM, ON APRIL 19TH, 1894,  
BY THE HON. SECRETARY.

EDWARD CONNOLD.

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The Paper was Illustrated with LANTERN VIEWS, DIAGRAMS,  
PHOTOGRAPHS, and NUMEROUS SPECIMENS of WASPS, NESTS,  
SECTIONS of COMBS, and the COVERINGS, &c., &c.

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# Wasps, and How They Live

(By EDWARD CONNOLD).

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*The following Paper was read before the Hastings and St. Leonards Natural History Society, by the Honorary Secretary, at the fortnightly meeting, in the Museum, Claremont, Hastings. The Paper was illustrated with numerous specimens of wasps and their nests, diagrams and lantern views of the interior and exterior of nests, legs of wasps, stings, &c. There was a large attendance of Members present.*

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**I**N order to be strictly correct, the title of this subject should read "British Social Wasps, and the Habitations they Construct." The reasons for this are threefold. The term "Wasps" is too broad for a short paper, as it embraces not only the wasps which are indigenous to our islands, but those to be found in other parts of the world (and there are a few in the tropics whose intimate acquaintance we should not care for). To mark the distinction we term those who favour us with their society "British"; the others are termed "Foreign" and "Exotic." The order of vespæ is divided into two divisions or groups, one called "solitary," the other "social." By solitary is meant that each insect lives by itself, making one cell only and not sharing it with another of its own order. In the social group (which we shall treat of in this paper) it is quite the opposite, for they live together in large numbers. Hence the necessity for distinction to be made between solitary wasps and social wasps. All future remarks will therefore apply to the latter class and not the former. The third reason for a change of title is that to attempt to describe how wasps live would open up too wide a field of study and discussion for the present purpose, embracing the whole of their social economy, which includes facts as well as theories, extending far beyond the confines of a paper; therefore I purpose inviting your attention to the exterior of the habitations they construct rather than to the interior.

Possibly no other insect in our country is the cause of so much dread as a wasp; there is an instinct within us after we have passed the age of childhood's innocence which upon its approach acquaints us instantly with the objectionable qualities it possesses, and we are bent upon its destruction at the first opportunity, or of getting out of its way as soon as possible. When they settle on the fruit or hover over the flowers in the garden, or having found their way into the house, alight on the sugar, jam, fruit, or even the meat and other articles of food on our meal table, the desire within us is for their annihilation, and even those not considered the boldest and the bravest will essay to kill. But the battle with a wasp is not always attended with victory on our side. They are quick, very quick, and carry small but very powerful and pungent weapons, the which, when we have failed on our part, but they have been successful in approaching us too closely, leave us worse for the fight. It is doubtful if one wasp in a thousand will sting unless it is driven to it—unless it is frightened or hurt, or disturbed in its plunder, and the chances are that the person who has courage enough to keep quiet when wasps are about, and allow them to settle where they please, or fly around them at their own sweet will, may escape the piercing sting.

The summer of the year 1893 will long be memorable as the great wasp year. During that summer wasps became a positive nuisance. They were to be met with everywhere, even along the beach. They robbed the orchards of pears, plums, damsons, apples, and cherries; while the peaches, apricots, and nectarines were ruined by these insects gnawing great holes in the green skins; grape-growers also suffered severely by their depredations. A report published in one paper said: "A grape-grower near Hastings has destroyed eighty wasps' nests near his vineries, and yet fears the voracious tribe will have destroyed fruit valued at £500." The destruction they committed in the orchards of this and the adjoining county (Kent) was very great, for they excavated the substance of vast quantities of apples, pears, and plums, leaving the skin and core, or stone, hanging from the bough so naturally as to baffle detection at first sight. But the probabilities were that if you had attempted, without due caution, to possess yourself of one of these curiosities of their industry, half-a-dozen of these hot-tempered thieves would have sallied out in the twinkling of an eye, and you would have got stung for your trouble.

It will be interesting to ascertain how it was that wasps were so abundant during the spring, summer, and autumn of 1893. It was said by some people that the reason of their abundance was that they were very plentiful during the previous year; others considered the mildness of the winters of 1892 and 1893 was the chief agent of the plague. Neither of these theories in my opinion is correct. The cause of their enormous quantity is to be attributed to the wonderfully dry and sunny weather experienced during the spring and early summer of last year. Ordinarily wasp life terminates in the autumn. The workers and the males die when the winter sets in, and the next year's stock is provided for by means of a few females that have been fertilized prior to their entering upon the state of torpor for the colder months. The females select shelters in which to pass this period either before or as soon as the remainder of the community die off. When spring returns, a few days of bright warm sunshine are sufficient to revive them, and they leave their retreat to find a suitable place to found a new colony. But the weather of the British spring is usually very variable, and if they are caught in a heavy shower or receive a chill from a sudden lowering of the temperature while thus employed, or when collecting the material for nest-making, and they are unable to regain their shelter, their end is death. Even though they may pass safely through these early perils and begin to build their homes, the rains that frequently visit these islands during the months of April, May, and sometimes June, very seriously hinder the building operations of those who select the boughs of trees on which to hang their nests; it also swamps the habitations of those made beneath the surface of the ground, rendering them unfit for such fastidious insects as wasps to remain in. Now, contrast all this with what the weather of the early part of last year actually was? The first two months had no very special features, but with March the sunshine and drought began. True, there was a considerable fall of snow on the second day of the month, but after the third or fourth day rain ceased to fall, and in place of the usual searching and proverbial east winds, day after day the breeze was from the west, soft and gentle; in fact, the month of March was the sunniest of the present century. April, also, brought not only sunshine such as had never before been known during that month, but heat quite equal to that of the warmest days of an ordinary summer. May, however, was not so sunny nor devoid of showers as April, but June brought the sunshine, the heat and the drought, in greater measure. Sometimes the heat was 92deg. in the

shade. Towards the end of the month a little rain fell, and the last day a south-westerly wind brought with it refreshing showers lasting over twelve hours. July, threatened, in its opening days, to be even warmer than June, but the dryness of the temperature was not so equally maintained. August, however, surpassed all others in its heat, keeping up the traditional warmth and sultriness. September brought a nearly average rainfall to most places, and as the great heat had ceased it was a most enjoyable month; October threatened us for a while with a second summer; and there was still an excess of sunshine in November until, about the 16th, a big storm from off the Atlantic introduced the commencement of wintry weather. Thus it may be seen that the climate was most favourable to wasps, delighting as they do in an absence of rains and wind but an abundance of brilliant hot sunshine.

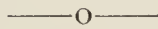
They keep up their visit till a late date, for on Wednesday, October 25th, 1893, while going through the Alexandra Park, at about 10 a.m., I observed a couple of wasps flying about very leisurely from spot to spot, apparently on the look out for a little hole or crevice in which to pass the winter. The morning was bright and sunny, but the chills of autumn were distinctly perceptible. If they were successful in their search and have remained undisturbed during the winter the warm sun of the past few weeks will have called them forth, and they are now busily engaged raising an army that ere long will number many thousands.

Of the seven species constituting the social group the hornet (*Vespa Crabro*) stands alone, it is the largest of all, and of a different colour; the other species are much smaller and are all nearly of the same size and colour except the workers of *V. Vulgaris*, which are generally rather below the average dimensions of the others. There are tree-wasps, so called from their building by preference above ground in trees, bushes, hedges, eaves of cottages or barns. They are *V. Britannica*, *V. Sylvestris*, and the rare *V. Arborea*. The other three species, which, from their building by preference underground, are called ground-wasps, are named *V. Germanica*, *V. Vulgaris*, and *V. Rufa*. For the purposes of classification the habits of these species are indicated in this way, but really individuals seem to adopt their own fancy in selecting a site for their future home. For instance, the hornet prefers to hang her nest from the rafters of a barn, the eaves of a cottage thatch, in the steeple or belfry of a country church, but she will



also build in a rotten or partly hollow tree, or a large post, and sometimes below ground. *V. Vulgaris* (the common wasp), although an underground builder by preference, does not object to similar open-air situations as the hornet, and instances are on record where she has made her home in such strange places as a dovecot, and a pump, and a Post Office wall letter-box. *V. Germanica* is spoken of as a ground-wasp, but it makes little difference to her, except that when building underground the fabric is not so clean and beautifully finished as when constructed above ground.

BRITISH SOCIAL WASPS.



VESPA CRABRO	HORNET.
„ BRITANNICA	} Build by preference above ground.
„ SYLVESTRIS	
„ ARBOREA.	
„ GERMANICA	} Build by preference under ground.
„ VULGARIS	
„ RUFA	

One more instance may be given, *V. Sylvestris* is regarded as a tree-wasp, and there is a nest (the property of the Museum Association), which was built among bracken in Beauport Park. There is before you another nest, built by the same species which I dug out of a bank in St. Helen's Wood during August of last year; and, within a foot of the entrance hole in the slope of the bank was also the "front door" of a large nest of *V. Vulgaris* portions of which are also shown.

Before dealing with the architecture and mode of constructing the nest it will be well to briefly consider a few of the principal parts of their exterior anatomy, noticing, in rotation, the tergumentary skeleton, the head, the thorax, the abdomen, and the sting; and that we may get a clearer conception of the divisions and sub-divisions, we will glance at the chart before us. Strange as it may seem it is none the less true that the skeleton—the bones in fact—of the wasp in common with all other insects are placed outside, and within are all the soft tissues thus placed out of the way of external injury or harm by this

bony covering. The skeleton is composed of chitin, a substance resembling horn in appearance, but the microscope reveals that it is totally unlike horn in structural arrangement and chemical composition. It is made up of two distinct layers closely connected, the outer one showing beautiful and varied colours, the inner one thinner and softer in texture but almost colourless. This chitin covering never grows. The abdomen may be drawn out or retracted, but the frame does not alter nor has it any means of repair any more than of growth, as Dr. Ormerod well puts it, "Considering the work which wasps have to do, and the circumstances of their daily life, no covering could be devised more exactly adapted to their wants than that which they possess. It is hard and resisting, yet as sensitive as our hard teeth; and in no other way could the same amount of material have been disposed to equal advantage according to mechanical laws." How could it be otherwise, when it is the work of the all-wise Creator? I do not purpose to pause just now for an examination of the interior of the skeleton, not even so much as the sting, that will find a place later on, but to proceed with the head.

The principal parts of the head that arrest our attention are the eyes, antennæ, corona, clypeus, and the mouth, the latter being divided into four other parts, which are of too much importance scientifically to be overlooked, but a detailed and technical explanation of all the parts would be wearisome, so we will glance at them but briefly. The eyes are of two kinds, simple and compound. The simple are very small, like three little shining points, black, sometimes marked with yellow, set in the form of a triangle with the apex pointing forward, on the top of the head. The compound eyes are one on each side of the head, each one made up of many hundreds of separate lenses, having many of the same parts as are found in the eyes of some of the higher animals, but in a rudimentary condition, covered with the cornea or horny membrane. It is said that these eyes take in distant objects and a wider field of vision than the other kind, which are constructed for close observation. Springing out of the head and close to the eyes are the antennæ. In the male there are thirteen joints, in the opposite sex there are but twelve. They deserve closer attention than time will permit now, but I must not pass over these points. The first joint is longer than any of the others, and the front of it is yellow in all sexes of the tree-wasps, and of the males of the ground-wasps.



The last joint is simple in the "social," but hooked in the "solitary" group. Almost everybody calls the antennæ feelers, and certainly one of their uses is to examine by touch everything presented to them; they are also instruments of communication, and organs of hearing; there may also be the sense of smell in a greater or lesser degree resident in them. How they convey information to one another in an intelligible form by means of these little jointed threads will perhaps never be known, but that they do so is a generally acknowledged fact by all naturalists. According to one writer on the subject, a longitudinal section shows that the antennæ are composed of a series of divisions opening one into the other, the central space from beginning to end being filled with a limpid fluid, nervous filament and minute air-tubes, which ramify over the interior of the horny covering. The corona needs but a passing notice. It is a little yellow patch, a part of the head, between the bases of the antennæ, of various shapes and sizes.

The clypeus we cannot dismiss so summarily from notice. It is the forehead, so to speak, on which is indelibly branded characteristic devices of the different species. It gives form and width to the face, and serves as a protection to the soft parts of the mouth, which lie behind and beneath it. The hornet occasionally has a single brown spot upon it, but all the other species have some mark or other. Other characters of distinction are to be found on the first and second rings of the abdomen, and in the colour of the scape (or first joint) of the antennæ. A close examination of all the parts of the mouth is perhaps a tedious occupation, and the description thereof bristles with intricacies and technicalities. In our own case, when we visit the dentist the sooner it is over the better we like it, but the student of wasp anatomy must give time and patience if he wishes to master this complex structure.

The mandibles are moved by a very powerful mass of muscles which lie just behind the compound eye on either side. The fibres converge from the inside of the rim which surrounds the face, to a tendon which is inserted into the mandible at its articulate extremity. We shall be able to form some idea of the work this apparatus can perform when we are considering the method employed in procuring and preparing the materials for the nests. "Wasps have no gizzard," says Dr. Ormerod, "no cutting or grinding instrument (such as crickets and cockroaches possess), placed

further in to break up any refractory morsels of food. Whatever is to be done in this way must be done by the mandibles. But wasps live mostly on pulpy matter or juices; they do not triturate hard substances into a digestible mass; they only break them down to get at the nutritive material which these contain. So their jaws are fitted with teeth rather for cutting, tearing and sawing, than for grinding; they are for collecting materials rather than for masticating food, and are shaped accordingly." All this portion of the insect's head is called the mouth, but it is difficult to trace any close comparisons between the parts of the mouth of insects and of mammalia. The figure of speech may be very convenient, but the resemblance is not great; and although the respective organs answer similar purposes, the various parts themselves are very differently constructed.

We will now pass on to a brief consideration of the thorax, the second main division of the insect's body. It is of very great importance in the insect's economy, for upon it are articulated each of the three pairs of legs, the two pairs of wings, and also the tegulæ, while it serves to support the head in front and the abdomen behind. The thorax is divided into three principal parts, each of which is sub-divided into four more, and as these are composed of a dorsal and a ventral plate—that is an upper and a lower—this organ is made up or built together of twenty-four separate pieces. Internally, there is found a most wonderful arrangement of bundles of muscular fibre, muscles for the wings, muscles for the legs, muscles for the air-passages, muscles for salivary glands and the stomach, muscles for the contraction or expansion of the various parts,—each, one and all, crossing and re-crossing one another, attached to their particular places, where they not only serve to sustain the framework, but are able to serve their purpose to the very best advantage. The muscles which move the wings are the largest and of rather a different kind to the others, but their action as elevators and depressors of the wings is supplemented in all its minor details by other smaller muscles, strong enough to guide though not to drive the wings, able to fold or expand them, to lock or unlock them at will, and to draw them at each moment into the right position for the stronger muscles to act upon them.

The legs are six in number, all alike in shape and colour; they are formed on the same plan as insects

generally: 1st, the coxa, or hip; 2nd, the trochanter; 3rd the femur, or thigh; 4th, the tibia, or shank; and 5th, the tarsi, which is sub-divided into five other joints, at the extremity of which are the claws. At the distal end of the tibiæ of both the metathoracic legs may be observed two long spines, the other four legs have only one, and apart from these they are unarmed, except with the usual complement of small hairs. They have four wings, the upper pair are larger than the under pair, and the placement of the nerves upon them varies much. They are a most complete and beautiful piece of network, fringed almost all round with microscopic hairs, while the glossy and transparent membrane is thickly studded with many thousands more. When expanded they are kept in the same plane by means of very small hooks called "hamuli," which are situated on the anterior margin of the smaller wing and fasten themselves into the posterior margin of the larger wing. It is said that these hooks vary much both in form and number in the different orders of hymenopterous insects, ranging from 3 to 57. There are also two small membranous scales called the tegulæ, or wing-covers, which protect the roots of the fore wings from injury.

We pass on now to the abdomen, or third main division of this tergumentary skeleton. Externally it bears a good many points of interest to the anatomist and thoughtful student; those which interest us most just now are the number of divisions or rings, and the sting; this latter member cannot be termed a distinctly outside appendage, but whenever a wasp visits us at close quarters the sting is so handy that before we have time to consider that point it is out and into our skin, therefore what matters, one way or the other! The abdomen is made up of a number of divisions, each one of which is sub-divided into a dorsal, or upper half, and a ventral, or lower half. The upper overlaps the lower, and each ring is overlapped by the one immediately preceding it to a variable extent; hence the size of the insect is materially altered whether the abdomen is extended or contracted; each ring is held in its place by special ligaments, and its action controlled by muscles of great strength. With reference to the colours and markings of the rings, in some the ground colour is bright yellow, in others it is orange yellow, or more of a gamboge hue, sometimes of an even redder tinge; the black markings vary considerably in shape, some are oval, oblong, or diamond, all, however, having a black band

round them. Their number is regulated according to the sex, the male having seven segments or rings, the other sex (which comprises the queens, the females, and the workers), having only six, but they are the possessors of that terrible little weapon, the sting. The males have no sting, they are not able to inflict any injury whatever, and may be allowed to run over the hands or face with as little or even less concern than ordinary flies; they can be recognized at a glance by two prominent features—longer antennæ and longer abdomen.

The sting consists of two very fine bristles. Along one side of each, from the point downwards for a short distance, they are serrated; this form of teeth renders it difficult of withdrawal when thrust into the flesh. When at rest these barbs are enclosed in the sheath, which is connected at its inner end with the muscular bulb, serving as a guide, without which such delicate instruments as the bristles, could scarcely be driven into any hard substance, while the fact of its tapering keeps them close together at their points. All along their inner surface they are grooved, so that when pressed together they form a closed tube, down which, with all the force the muscular walls of the poison-bag can exert, the venom is injected quite to the bottom of the wound. Many are the remedies which have been suggested as a cure when stung. Years ago, as far back as 1600 indeed, mint and mallow, and poultices made of aromatic herbs were used; then followed a mixture of coriander and sugar, or a poultice made of the offending insect's body; later days have brought tobacco, a watch-key, the blue bag, vinegar and water, a raw onion, ammonia, soda, ipecacuanha, and chloroform into use, and it is difficult to say which is best, but one plan may always be adopted with soothing effect, and that is to suck the wound, if it can be got at, but above all leave the wound alone. The poison from the sting does not affect some people, but others suffer very much, and cases have been known where death has resulted from the effects of being stung. The caudal palpi are considered by some naturalists to be accessories of the sting; by others to be employed in receiving the egg from the oviduct and to fix it to the wall of the cell. The stigmata, or external orifices of the respiratory apparatus in this division of the body, lie in a row on each side, one at either end of each dorsal scale. Within the abdomen are the digestive and reproductive organs, the respiratory system, the centres of the nerves and a very large proportion of the muscular arrangements. There is no spare room, nor is it too crowded.

Having now briefly reviewed the exterior of the tergumentary skeleton, we will direct our thoughts to the second part of the subject, viz.: the habitations wasps construct.

In the earliest stages of the building of a wasp's nest it is not easy to decide as to which species it may belong. The first rudiments of the nest appear in the form of a foot stalk, made of the same material as the other part of the nest, spread out at the top and fastened to the branch or whatever place the wasp may select; hanging from this are the cells, three or four in number, each containing an egg. Then a little cap of the same material is made, which very soon increases in size, until it entirely shuts the cells out of view. To these others are quickly added, each containing an egg deposited by the mother wasp, and simultaneously with these building operations it is necessary for her to provide the growing larvæ with nourishment, which consists of small caterpillars, spiders, &c. For a little while it is hard work. All this is the work of the mother wasp alone, and it is the beginning of the multiplication, which continues until there are sometimes as many as 10,000 cells in one nest. After about a fortnight from the commencement of building, the few first larvæ issue forth as perfect insects, and at once assist her in building the fabric and feeding the grubs. Other workers follow speedily, and, ultimately, she is entirely relieved of all further labour, beyond the laying of eggs, and from that time she reigns as "queen."

The building of the cells is an operation which can only be watched with great difficulty, and I believe it is yet a matter of doubt as to how the beautifully symmetrical proportions are obtained. In shape they are hexagonal, and made of exactly the same material as the other part of the nest, but are rather thicker, of a closer texture, and require greater care in construction. They are found to vary in number, from 16 to 45 to the superficial square inch. They are not built to the full size until the growth of the grub inside renders it necessary. As soon as possible the outer covering is made so that it envelopes the comb entirely, and it is most wonderful that although cells are constantly being added to those already made, and new combs are suspended from the others, the exterior always remains in a more or less spherical form. As the interior grows larger day by day, the envelope is cut away from the inside to make room, and new layers added on the outer surface. It is not transferred from one part of the envelope to the other without being nibbled down and worked



up into a pulp as in the first instance ; this mode of enlargement requires a very much greater amount of labour and material than if the habitation could have been mapped out on a larger scale at the commencement. However, this arrangement is absolutely necessary. The brood must be protected from damp or wet, the nursery must be shielded from inquisitive eyes ; closed against maurading visitors, such as beetles, earwigs, snails, and others ; kept from draughts and maintained at a certain temperature to enable the grubs to mature.

Before one comb has attained its fullest dimensions, another is begun, the walls of two or three adjoining cells in the centre of the lowest comb are lengthened and form a small pillar, at the end of which a cell is built, and as its walls are lengthening the comb is gradually being enlarged by rings of cells ; the increasing weight and size being supported by new pillars, or connecting rods. The queen wasp follows close on the operations of the builders, and as each cell takes shape an egg is deposited in it so as to lose no time. A circular comb of average size, measuring seven inches in diameter, will be made up of over 2,000 cells. Wasps that make their nests below ground appear to be more industrious than those who build pensile nests, for as the home grows in size accommodation must be made for its increase, and to the other duties is added that of excavating the earth. This is done by means of the mandibles. When a piece of convenient size has been bitten off it is carried between the legs some distance away from the entrance hole before it is dropped. I have caught wasps flying away from the nest with their load of earth or stone, the weight of which is often times over  $1\frac{1}{2}$  grains. But where the ground is very stony the heavier pieces are simply pushed outside.

The taking of a wasp's nest is not always an easy matter. The pensile nests, according to their situation, are more or less the most difficult to secure. Great care is necessary in being protected against the attacks of the inmates, for they are wonderfully clever in discovering any unprotected part of your face and hands. Nothing will anger wasps more than disturbing their home. Those built in a bank are the easiest to obtain, but it requires care and patience, and if the object be to preserve the nest as a specimen for the cabinet a little of the "know how" is indispensable. Between June 1st and October 4th of last year, I dug out 25 nests ; of these, 18 were of *V. Vulgaris*, six *V. Germanica* and one *V. Sylvestris* (built underground). I hope to secure

a pensile nest during this summer. One morning during my holiday in the country I dug out nine. One nest, taken out of a bank in St. Helen's Wood on July 13th, 1893, was photographed for me by my father; it had been made by *V. Vulgaris*, and had assumed a rather peculiar shape by reason of a large stone imbedded in the earth which the wasps had not been able to remove. On taking the nest to pieces I found there were eight combs, the measurements of which yielded a superficial area of about 188 square inches, and as the cells were made 42 to the superficial square inch, it contained nearly 8,000 cells, most (if not all) of which would have been used three times each for successive generations of grubs. This nest would ultimately have been the home of some 22,000 wasps, leaving a margin for casualties.

The materials used by wasps in making both the combs and the envelope are various. The scrapings of sound and rotten wood are principally used, but vegetable fibres from the stalks of various bushes, the downy leaves of plants and trees, filaments of grass, and the outer skin of young oak shoots are used; ordinary paper is occasionally employed in the fabric, and sand is now and then found mixed in. This, however, may be due to its falling upon the envelope when excavations are in progress to make way for the enlargement of the nest. Whatever the materials may be (with exception of the sand) they are all treated exactly alike, the fragments are bitten off with the jaws, worked up into a pulp with moisture from the mouth, rolled into a little pellet, tucked under the chin, as it were, and then carried off to the nest to be added to the general building. The method in which it is applied is described by one writer thus, "Mounted astride on the edge of one of the covering sheets, she pressed her pellet firmly down with her fore legs till it adhered to the edge, and walking backwards continued the same progress of pressing and kneading till the pellet was used up, and her track was marked by a short dark cord lying along the thin edge to which she had fastened it. Then she run forwards, and, returning again backwards over the same ground, drew the cord through her mandibles, repeating this process two or three times till it was flattened out into a little strip or ribbon of paper." Sometimes one wasp will collect white fibres and join them to that which another wasp has previously built of a dark colour. With *V. Vulgaris* this is the regular plan of work, and where the colours are vivid the variegated appearance is very pretty.

One nest of *V. Vulgaris* that I dug out on October 3rd, 1893, is of special interest. As it was getting late in the year it was not surprising to find the three upper combs quite empty of grubs, and over portions of each a quantity of material like the envelope itself had been spread in a very confused manner, many of the cells being entirely covered over. But the point of interest concerning this particular nest was the presence in vast numbers of a mite. From descriptions given by Andrew Murray, F.L.S., in his *Economic Entomology (Aptera)* it appears to be *Tyroglyphus entomophagus*. Allied species of this mite are to be found on hyacinths, potato and dahlia roots, and also upon mushrooms, therefore it is quite possible they may have been brought to the nest on the legs and bodies of the wasps themselves.

Very few words are required to explain how the pensile nests of tree-wasps are fastened to the branch of the tree or bush. A broad strap-shaped piece of many layers is firmly attached to the bough, and upon this hangs the whole weight of the nest. As the structure increases in size, this point of connection is strengthened by other layers. Sometimes the tree-wasps build in a bush or amongst braken; in such cases the surrounding boughs and twigs are used as a kind of scaffolding. Although the nests of the ground-wasps are made below ground, and are surrounded on all sides by earth, the envelope is not in contact with it except at the top, where it is suspended from above by means of connecting rods, made of the same material as the remainder of the fabric, of great strength and increasing in number, according to the weight and size of the building. Sometimes a large stone, or the root of a shrub, interferes with the work of enlargement; strenuous efforts are then made for the removal of such obstacles, but when unsuccessful the roots assist in supporting the weight of the combs, and the stones make dentations in the envelope altering it from a spheroid to an irregular shape. Very much more could be said about wasps and the homes they inhabit, but it is not advisable to lengthen this paper; therefore, I will close at this point and in so doing, mention that their chief aim in life is the housing and feeding of their young, towards whom they show the greatest attention, forethought, and care. May I also suggest that although they are such unwelcome visitors in the home, they teach us lessons of energy, hard work, and unselfish industry, such as are worthy of emulation.

# POPULAR LECTURES

— ON —

# Natural \* History

— BY —

Mr. EDWARD CONNOLD.

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## LECTURE I.

### “The Structure and Habits of Gaterpillars.”

Illustrated with 38 beautiful Photographic Views, descriptive of the Life, Growth, and Habits of a Caterpillar.

## LECTURE II.

### “Familiar Shells.”

Illustrated with 40 beautiful Photographic Views, descriptive of the Formation and Development of Body and Shell of various common Molluscs.

## LECTURE III.

### “Familiar Insects.”

Illustrated with 40 beautiful Photographic Views, descriptive of the interior and exterior anatomy of a few and well-known Insects.

Each LECTURE is illustrated with a complete and comprehensive Series of Views, which have been carefully selected from NATURE, SPECIMENS both beautiful and rare, PRINTS in Standard Works on NATURAL HISTORY, and also DRAWINGS of the objects as viewed under the MICROSCOPE, and Photographed specially for these LECTURES.

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All the Slides are 3¼-ins. by 3¼-ins.  
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*Each Lecture occupies about One Hour and Twenty Minutes.*

**Terms, &c., on Application.**



## Unsolicited Press Comments upon the Lectures.



- “An extremely interesting Lecture.”
- “Described with great minuteness and precision.”
- “A large audience listened with evident pleasure.”
- “Most interesting and instructive.”
- “Interspersed with marvellous statements.”
- “Instruction so ably given was much appreciated.”
- “Listened to by the audience with great attention.”
- “Very lucid and interesting explanations.”
- “Lantern illustrations added greatly to the interest.”
- “It was a very interesting discourse.”
- “Many humorous touches and apt poetic quotations.”
- “The audience were surprised at the amount of instruction.”
- “Described in a lucid manner.”
- “Interesting, exhaustive, and instructive.”
- “A large number of beautiful photographic views.”
- “Dealt with in a very minute and able manner.”
- “The audience followed with great attention.”
- “Lantern views illustrated the subject throughout and evoked much applause.”



